of this material are now obtainable which withstand rapid fluctuations of temperature. The section on the noble metals refers not only to vessels of gold and platinum, but also to apparatus constructed of rhodium, iridium, and tantalum. The chemical and physical properties of the newer alloys (duralumin, the ternary steels, &c.) are reviewed. Scattered through the work are many valuable recipes likely to interest the practical chemist, as, for example, the use of aniline-black as a stain for woodwork, various lutings and cements for joining together chemical apparatus, and a composition for filling holes in platinum crucibles.

Special chapters are devoted to electrical fittings and to the mechanical operations of pulverisation, agitation, filtration, &c. The book affords a striking testimony of the pre-eminence of Germany in the newer industries which minister to the wants of applied chemistry. Some noteworthy products of British enterprise have, however, been overlooked, and mention may be made in this connection of Fletcher's earthenware combustion furnaces and Pilkington's glass screens with an embedded meshwork of invar steel, which form such efficient shields in working with explosive materials.

(3) In this text-book of organic chemistry the author has given prominence to the development of the theory of the subject, descriptive matter being restricted to a few substances of industrial importance. A chapter on chemical kinetics has been added because the fundamental principles of this branch of the science have been chiefly verified in connection with organic substances. From the outset stereochemical considerations are introduced, and the facts of isomerism, multiple linking, and ring formation are regarded from the point of view of the tetrahedral carbon atom. The constitution ascribed to double cyanides (pp. 174, 177) must, however, be regarded as obsolete, in view of Werner's recent researches on coordination compounds. The author omits all references to original memoirs, and the work can scarcely be recommended as a substitute for the larger English treatises on organic chemistry.

(4) This work is the seventh volume of the fourth edition of Allen's well-known treatise on organic analysis. The book is divided into seven sections, each of which is written by an expert on the subject, the entire compilation not only serving as a useful guide to the analyst, but forming also a comprehensive treatise on the general chemistry of the organic materials under review. The present volume is largely devoted to nitrogenous compounds either formed by the vital activities of plants and animals or arising from the decay of these organisms. In recent years considerable addition has been made to our knowledge of these products, among which may be mentioned the alkaloids of ergot, cyanogenetic glucosides, ptomaines, amino-acids, and purine derivatives. One section is devoted to lactic acid, and another to the bitter principles of aloes and hops, whilst the concluding chapter is a useful monograph on cyanogen and its derivatives.

G. T. M.

SOME NEW ELECTRICAL BOOKS.

(1) *Electrical Photometry and Illumination: A Treatise on Light and its Distribution, Photometric Apparatus, and Illuminating Engineering.* By Prof. H. Bohle. Pp. xi + 222. (London: C. Griffin and Co., Ltd., 1912.) Price 10*s.* 6*d.* net.

(2) *The Principles of Applied Electrochemistry.* By Dr. A. J. Allmand. Pp. xii + 547. (London: Edward Arnold, 1912.) Price 18*s.* net.

(3) *Electroplating: A Treatise on the Electro-Deposition of Metals, with a chapter on Metal-Colouring and Bronzing.* By W. R. Barclay and C. H. Hainsworth. Pp. viii + 399. (London: Edward Arnold, 1912.) Price 7*s.* 6*d.* net.

(4) *The Design of Alternating Current Machinery.* By J. R. Barr and R. D. Archibald. Pp. xvi + 496 + xvi plates. (London: Whittaker and Co., 1913.) Price 12*s.* 6*d* net.

(5) *A Laboratory Manual of Alternating Currents.* By Prof. J. H. Morecroft. Pp. viii + 247. (London: Longmans, Green and Co., 1912.) Price 7*s.* 6*d.* net.

(6) *La Télégraphie et la Téléphonic Simultanées et la Téléphonie Multiple.* By K. Berger. Traduit par P. Le Normand. Pp. 134. (Paris: Gauthier-Villars, 1913.) Price 4.50 francs.

(7) *The Baudôt Printing Telegraph System.* By H. W. Pendry. Pp. iii + 147 + plates. (London: Whittaker and Co., 1913.) Price 2*s.* 6*d.* net.

(1) DURING comparatively recent years there has sprung into existence a new branch of science which is known, or knows itself, as illuminating engineering. The writer has a suspicion that if the electrical engineer who handled lighting problems had not been on the lookout for another stick with which to beat his brother gas engineer, and had not thought that stick was to be found in the greater ease with which scientific measurements can be applied to electric lamps, no such science would ever have sprung into a definite and separate existence. Be that as it may, the profession appears to be establishing itself with some degree of firmness. The illuminating engineer of theory is a man of unbiassed mind as regards the particular illuminant he employs, provided he attains his desired end in the most economical

manner: a man who instals electricity in your dining-room, gas in your kitchen, acetylene in your billiard room, and candles in your bedroom. But the illuminating engineer of practice is generally either a gas or electrical engineer with his own particular axe to grind. So much is this the case that he may show a marked preference (against all sound illuminating engineering doctrine) for a particular species of illuminant in the genus which he represents—as, for example, for flame arc lamps against all other electrical illuminants.

We do not know whether Prof. H. Bohle calls himself an illuminating engineer, but at least he has written a book (1) which claims in its subtitle to be a treatise on illuminating engineering, almost as if this were a mere appanage of electrical photometry and illumination; and, as one of the latest works on the new science, we turn to it naturally in the hope that it will more than justify that science's existence. It is disappointing to find little, if anything, more than used in our student days to be regarded as legitimately within the sphere of electrical engineering. It is disappointing, too, to find much inadequate treatment and, we are afraid, insufficient knowledge. Take, for example, the discussion of radiation laws in chapter ii. This is far from clear, and the statement on p. 21: "Coloured bodies absorb different parts of the impinged radiation: consequently they will radiate different fractions of black body radiations, according to the frequency, *i.e.* according to the temperature," is, if we understand the author's meaning rightly, not correct.

The description of the manufacture of carbon filament lamps in the same chapter must have been obtained from some out-of-date account. The criticism of the flame arc lamp on p. 97 is equally behind the times. It is stated that "on long winter evenings the lamps do not hold out until the next morning, but must be recarboned during the night." This is untrue of any flame lamps except those specially designed for short-hour lighting, and there are many flame lamps now on the market, and have been for years, which burn without recarboning for 70-100 hours, so that it will be seen that the criticisms of the author, who writes from Cape Town, would only be justified at the poles. Flame lamps burning vertical carbons are actually commended for steadiness as against lamps with inclined carbons, the exact reverse being the case. We were not surprised after this to find on p. 171 that the yellow flame arc is described as "suitable for decorative illumination," as apparently its only sphere of usefulness.

We need not, however, labour criticism of details such as these: it is only to be regretted that in discussing such a progressive subject as the manufacture and behaviour of electric lamps the author did not take more pains to bring his information up to date.

It is of interest to turn to what may be regarded as the more distinctly "illuminating engineering" sections of the book. We are told in the preface that this is a combined science of physics and physiology, and emphasis is laid on the neglect of the physiological side, which led us to expect that this would be remedied by the author. The physiological discussion in the book is, however, no more than is usually to be found in similar works. In truth, this plea for physiological investigation is, in our opinion, frequently exaggerated. The knowledge of a few elementary facts is necessary, but beyond this physiological knowledge is not needed, and it would be equally true to say that it was required as part of the equipment of a good tailor.

The last two chapters, "The Design of Reflectors and Shades" and "Illuminating Engineering," show how little the new science really has accomplished. With a few exceptions, which existed before the illuminating engineer had arrived, electric lamp shades are still, scientifically, as chaotic as ever. The design of shades is, in fact, for the most part, an art and should continue to be so: if the illuminating engineer ever succeeds in making it purely a science, he will remove what is one of the recommendations of electric lighting—that it lends itself to beauty as well as to utility. The chapter on illuminating engineering gives a number of directions for different classes of lighting which the unbiassed would admit are no more than a restatement of the common-sense practice of years—almost centuries.

We cannot omit reference to a novel procedure in the numbering of figures and equations. Thus the fifth figure in the fourth chapter is numbered Fig. 4.05: this is intended to facilitate reference. It has quite the contrary effect and we trust will not be imitated.

(2) Dr. Allmand's treatise is one of the most comprehensive and at the same time one of the best treatises on applied electrochemistry that we can call to mind in the English language. The first part, covering fourteen chapters and 194 pages, deals with the theoretical side of the subject. To write a complete exposition of the theoretical side of electrochemistry, it would almost be necessary to write a complete chemical treatise coupled with a much shorter discussion of the fundamental electrical phenomena. It is

essential, therefore, to assume a certain amount of chemical knowledge in the reader, and we are inclined to think, on the whole, that Dr. Allmand has not assumed too much.

It must be remembered however, that the student who approaches this subject from the electrical side is often seriously lacking in chemical grounding and, complete though Dr. Allmand's treatment is, we could not help feeling at times that the chemical reasoning and illustrations would be above the heads of many readers. This argument must not be given undue weight, as it is open to all who care to study the subject thoroughly to supplement the volume by the reading of other chemical and physico-chemical works, a matter which is greatly facilitated by the copious references to current literature and the bibliographical references at the end of each chapter. By the time the student has thoroughly mastered the theoretical discussion in the first part of the book he will be in a position to understand properly the reactions and phenomena involved in the various practical applications to which the second part is devoted.

The "special and technical" part of the work opens with two chapters on primary and secondary cells respectively. The treatment here is necessarily brief—whole volumes have been written dealing with each of these subjects—but it is clear and covers the more important points. An interesting discussion of the "fuel cell," a cell in which coal, or some simple derivative from coal such as carbon, or CO, is used to generate electrical energy, concludes the chapter on primary cells. There follow chapters on the electro-metallurgy of the principal metals, and on electrolytic bleaching, etc., and in chapters xxiv. to xxvi. the more important electro-thermic processes are discussed. The last two chapters deal with the oxidation of atmospheric nitrogen and the production of ozone.

Although, owing to natural conditions, this country is not to the fore in electrochemical and electrothermal development, the field for English engineers is not confined to England. There is good reason to hope, moreover, that the future, and very possibly the near future, will see much greater advances in this direction in England than one would have anticipated a few years ago. It is becoming more evident every year that not only is water power not an indispensable adjunct to electrochemical enterprises, but that other sources of power may possess decided advantages. The appearance of so thoroughly sound a treatise as Dr. Allmand's is therefore very much to be welcomed.

(3) Messrs. Barclay and Hainsworth have set out to write a thoroughly up-to-date handbook for the practical electroplater, and have succeeded admirably in realising their aim. Rightly insisting that even the most practical of practical men cannot in these days work without a more or less thorough groundwork in the theoretical side of his subject, they have devoted the first six chapters of their book to a succinct but thoroughly sound exposition of the fundamental chemical and electrical principles. These are treated in a manner well suited to the scope of the book, the elementary knowledge assumed being such as can hardly fail to be possessed by anyone seriously attempting to study the volume.

After two chapters dealing with plant and apparatus and preliminary processes such as cleaning, etc., the remaining chapters deal with the deposition of the various metals. Each of the more important metals is considered separately, and in each case the theoretical explanation of the various reactions involved is not forgotten. The composition of the various depositing baths having been considered from this viewpoint, the methods of making them up and the details of the actual electroplating process are dealt with. The book covers the deposition of all the metals of importance industrially and also of many the deposition of which has a very limited application. We can thoroughly recommend the book either to the practical electroplater or to the student anxious to familiarise himself with the details of a process of great commercial importance and great historical interest.

(4) Messrs. Barr and Archibald's volume on alternating current machinery is an advanced treatise suitable for the use of senior students and those actually engaged in the design of such machinery. The whole field is well covered: after preliminary chapters on complex wave forms and insulation, the subject of transformer design is dealt with in three chapters. These are followed by eight chapters on alternators and three on rotary converters.

(5) Mr. Morecroft's book is a collection of laboratory experiments designed to elucidate the more important current phenomena. We are glad to see that a method too frequently followed by the writers of such laboratory notes, that of confining the text to the merest statement of instructions, has been avoided and a clear exposition of the significance of the experiment has been given in each case. Although this may render the book less convenient for actual use in the test-room, it gives it much higher educational value.

(6) and (7) These two books deal with specific developments in the field of telegraphy and telephony, and may be regarded more as mono-

graphs for the specialist than as treatises for the general student. The detailed investigation of the more intricate telegraph systems is, in fact, probably outside the range of the general electrical engineer's ambitions. M. Berger's book is the more comprehensive of the two, not only because it deals with a somewhat wider subject, but also on account of the broader method of treatment which has been adopted. The subject is handled more theoretically, and there is very little purely descriptive writing. M. Pendry, on the other hand, deals mainly in description, and the book lacks something from the absence of the theoretical side. The descriptive writing is, however, clear, and numerous illustrations help to the better understanding of a very complex subject.

MAURICE SOLOMON.

THE TEACHING OF PSYCHOLOGY.

(1) *The Learning Process.* By Prof. S. S. Colvin. Pp. xxv + 336. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 5*s.* 6*d.* net.

(2) *Introduction to Psychology.* By Prof. R. M. Yerkes. Pp. xii + 427. (London: G. Bell and Sons; New York: H. Holt and Co., 1911.) Price 6*s.* 6*d.* net.

(3) *Experiments in Educational Psychology.* By Dr. D. Starch. Pp. vii + 183. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 4*s.* net.

(1) PROF. COLVIN'S book is written from the point of view of "thorough-going functionalism and pragmatism." "All learning," we are told, "both expresses itself through adjustment and is acquired through adjustment." Now it is possible to give too narrow a meaning to the term adjustment. The solving of a problem, however theoretical, is adjustment in the important sense. That movement, on the other hand, is not the one thing needful has been made evident once for all by Mr. Squeers' pedagogic system:—"W-i-n-d-o-w, window, go and clean it." In short, the essential thing is that every piece of school work should be capable of being felt as a stage in the working out of a problem.

Prof. Colvin, it is true, does not definitely commit himself to too narrow a use of the term; indeed, in places he clearly guards himself against it. Yet one cannot but feel that these passages come rather as qualifications than as explanations of other earlier ones.

One problem which lends itself particularly well to treatment from this functional point of view is that of the expression and suppression of deep-seated emotional and conative tendencies. An interesting account is given of some of Freud's main positions, and sympathy is shown with the view that the attempt simply to suppress fundamental instincts is apt to be disastrous rather than merely futile. The problem of sex education is recognised, and the possibility faced that childhood may not be so completely asexual as has been supposed. That the existence of any problem has been so completely ignored is certainly strange, but, as things are, is perhaps hardly an unmixed evil. The child has in this domain at least been spared the interference of the many well-intentioned, the parents, parsons, and pedagogues, who would otherwise surely have rushed in, fearing to tread as little as any bull in a china-shop.

Many other topics are interestingly and instructively discussed—the economy and technique of learning; the main results of recent work on testimony; the problem of the transfer of training; the comparison of child and adult as to memory and reason; "hard" versus "soft" pedagogy, and so on.

The book is clearly written, and gives, without ostentation, a large amount of information based upon modern experimental work.

(2) The most original feature of Prof. Yerkes' book is its scope and arrangement. It is intended to be an introductory outline as distinguished from a manual, that is, to arouse interest and indicate the problems with which psychology deals rather than to give a systematic account of the main facts and theories. It has the defects as well as the qualities of this plan. On one hand it contains much interesting material not commonly to be found in elementary books. On the other, its treatment is of excessively varying thoroughness. Excellent features are the texts which head each chapter, consisting of quotations, often of some length, from some more advanced book or clever piece of research, and the practical exercises, intended, however, exclusively for class work, with which the chapters end.

Special topics of which the treatment seems less satisfactory are: the difficult question of the exact theoretical difference between introspection and "external perception"; the criticism of the "tripartite division" of consciousness; the use of "sentiment" in the sense of "an emotion which attaches itself to a particular object." A sentence on the final page is apparently incomplete.

(3) Prof. Starch's little book aims at providing a course of experiments in educational psychology for a small class, the work to occupy two hours weekly through one semester. For its purpose it seems to be excellent, though the verbal material of the experiments, having been selected from an